

Claims: -

1. A digital subscriber line (DSL) modem comprising a line interface transformer having a primary circuit for coupling to a transmission line and a secondary circuit for outputting a signal transmitted over said transmission line, each circuit being formed of a continuous electrically conductive material and in which the primary circuit and the secondary circuit are substantially parallel and are in substantially the same plane.
- 5 2. A DSL modem as claimed in claim 1 wherein said primary circuit and said secondary circuit are in the form substantially parallel spirals of the conductive material in substantially the same plane.
- 10 3. A DSL modem as claimed in claim 2, wherein the spiral is substantially circular, elliptical, square, rectangular, oval or non-regular.
4. A DSL modem as claimed in claims 2 or 3 in which the spiral conforms substantially to a spiral formed by the polar equation  $r(\theta) = \alpha\theta$ , where  $\theta$  is the angle in polar coordinates,  $r$  is the radius and  $\alpha$  is a constant that regulates the number of turns and the spacing.
- 15 5. A DSL modem as claimed in any one of the preceding claims, wherein a number of turns of each circuit is at least 10.
6. A DSL modem as claimed in any preceding claim, wherein there is plurality of planes, each plane forming a layer and in which said primary circuit of each layer is connected together and said secondary circuit of each layer is connected together.
- 20 7. A DSL modem as claimed in claim 6, wherein said layers are substantially parallel.
8. A DSL modem as claimed in claim 7, wherein the separation between said layers is not more than 0.5mm.
- 25 9. A DSL modem as claimed in claim 6, 7 or 8, wherein the primary circuits are connected in parallel or in series with one another, and the secondary circuits are connected in parallel or series with one another.
10. A DSL modem as claimed in any of claims 6 to 9, wherein there are at least 10 layers.
- 30 11. A DSL modem as claimed in any one of claims 6 to 10 having an aspect ratio defined as diameter to width of 1:5 or more.
12. A DSL modem as claimed in any one of the preceding claims, wherein said line interface transformer does not comprise ferromagnetic core.
13. For use in a DSL modem, a line interface transformer having any of the line

interface transformer features of any preceding claim.

14. A method of transmitting electronic data over a transmission line, which method comprises the steps of placing said electronic data on said transmission line using a line interface transformer as claimed in any preceding claim.
- 5 15. A method of manufacturing DSL modem, which method comprises the step of inserting a line interface transformer according to claim 15 and electrically connecting said transformer thereto.
- 10 16. A coreless transformer for passing a low frequency band digital data signal between about 10kHz and 2MHz, which transformer comprises a primary circuit and a secondary circuit having a number of turns such that said transformer comprises a plurality of layers, each layer having alternating primary and secondary conductors adjacent one another, there being a combination of said number of turns and a number of layers sufficient to obtain a transformer action for passing said digital data signal from said primary circuit to said secondary circuit.
- 15 17. A coreless transformer as claimed in claim 16, wherein said layer extends radially outwardly from a centre of said transformer.
18. A coreless transformer as claimed in claim 16 or 17, wherein said layer forms an annulus around an axis of said transformer.
- 20 19. A coreless transformer as claimed in claim 16, 17, or 18, wherein separation between said primary and secondary conductors is between about 0.02mm and 0.075mm.
- 20 20. A coreless transformer as claimed in any of claims 16 to 19, wherein the separation between each layers is between about 0.02mm and 0.2mm.
- 25 21. A coreless transformer as claimed in any of claims 16 to 20 wherein there are at least ten layers.
22. An electrical circuit comprising a coreless transformer according to any of claims 16 to 21.
23. A DSL modem comprising an electrical circuit as claimed in claim 22.